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MILITARY ENGINEERING EXPERIMENTAL ESTABLISHMENT, CHRISTCHURCH.

REPORT No 612

SUBJECT

REVIEW ON Nov. 86

TRIALS OF PLASTIC EXPLOSIVE DG 20 AND DG 29

Project E/D/7(b)

DATE November, 1956.

Reg 11868.

[redacted]

M.E.X.E. TEST REPORT NO. 612

TRIALS OF PLASTIC EXPLOSIVE DG 20 AND DG 29

Project E/D/7(b)

1. OBJECT.

To determine whether the new British Plastic Explosives DG 20 and DG 29 meet the War Office requirements, to compare their characteristics with those of PE 3A and the U.S. explosive C4, and to make recommendations as to whether they should be made more or less plastic.

2. PREAMBLE.

The programme of trials was laid down by the Ordnance Board in O.B. Proceedings 38,388 (special) dated 24 January 1956 Appendix II and is reproduced in this Test Report at Appendix 3.

The revised W.O. Military Characteristics (70/Expl/570-GS(W)2 dated 17 April 1955) to which the explosives are required to conform is given in Appendix I of the same Proc. and is summarised in Appendix 2 of this Test Report.

Packaged trials and sensitivity trials against H.E. splinters are being arranged separately by the Ordnance Board who are also to consider in due course the necessity of submitting the chosen explosive to cold weather trials in Canada and trials after storage at the T.T.E.

3. DATE AND LOCATION.

January to October 1956.
BOVINGTON Demolition Ground.

4. OFFICERS PRESENT.

Lt. Col. J. W. N. Landor, R.E. (Retd.)
S/Sgt. W. R. Davies, R.E.

5. SUMMARY OF RESULTS AND CONCLUSIONS.

Both DG 20 and DG 29 are equal to or better than PE 3A in all properties tested in this report, are better than C4 in most respects, and comply with all W.O. requirements except handling at very low temperatures and deterioration in storage.

As produced, the Plasticity of both is just right for use in normal temperate climates.

OPINION OF T.S.O.1 EXPLOSIVES GROUP

(a) I agree with the above conclusions.

(b) The deterioration in the plasticity of DG 20 and DG 29 after ISAT/B conditioning is only slight, and very much less marked than that of PE 3(a). However, it might be advisable to obtain an opinion, or further evidence, on the likely effect of this on the explosives after ten years tropical storage.

(c) The handling properties of DG 20 and DG 29 at low temperatures could best be investigated further, if required, by cold weather trials in Canada.

(Sgd.) R. A. Blakeway,
Lt. Col., R.E.
3rd December, 1956. T.S.O.1, Explosives Group.

COMMENTS OF DIRECTOR

I agree with the opinion of T.S.O.1 Explosives Group above. DG 20 and DG 29 are a marked improvement on PE 3A. Further investigations as above are however desirable.

(Sgd.) L. R. E. Fayle,
Brigadier,
4th December, 1956. Director.

COMMENTS BY DREE

As far as the characteristics described in this report are concerned, both these explosives are sufficient improvement on PE3A, to justify their adoption for Service use. Additional trials with explosives in their service packages will be required, to confirm the degree of deterioration in plasticity after prolonged storage under tropical conditions, and the ease of handling at low temperatures.

S. A. STEWART,
Brigadier, D.R.E.E.

COMMENTS BY US. ASG(UK) ENGINEER REPRESENTATIVE.

I have no comment.

(Sgd.) John F. Kimbel,
Major, C.E.
28 December, 1956. Engineer Representative.

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M.E.X.E. TEST REPORT NO. 612

6. DESCRIPTION OF TRIALS AND RESULTS

(a) Trial No 1/1. Handling of new explosive at normal temperature.

During the several trials following there was ample opportunity to compare the four PEs as regards:-

(i) Ease of working to shape and pressing into a mould.

(ii) Liability to crumble or break apart.

(iii) Cleanliness in handling.

(iv) Physiological effects.

At temperatures between 40° and 60° F. all four explosives were easily moulded and retained the shape imposed on them.

The PE 3A was dirty to handle and both it and the C4 had the undesirable property of sticking to warm fingers.

The DG 29 had better cohesion than DG 20 in that two cartridges were more easily rolled together into a homogeneous mass; on the other hand DG 20 was preferable to DG 29 as regards stickiness to handle. Both were markedly superior to PE 3A and C4 in all handling tests at normal temperatures.

None of these explosives caused headache or skin irritation.

The C4 had a density only 4/5 that of the other PEs.

(b) Trial No 1/2. Handling of new explosive at temperatures between -65° and +160° F.

The four explosives were lowered in temperature to -65° F. and observations made as in trial No 1/1.

They were then heated to +160° F. and again handling tests were applied at intervals.

Table No 1 in Appendix 1 gives a comparative table of results.

Only the DG 20 was satisfactory throughout this temperature range, but at the higher temperatures and down to -40° F. there was nothing to choose between DG 20 and DG 29.

(c) Trial No 1/3. Handling after 6 months ISAT/B at normal temperature.

Trial No 1/1 was repeated with the ISAT treated explosives at normal temps.

The PE 3A was practically unusable as a plastic.

The DG 20 and DG 29 were somewhat dried up but still quite satisfactory.

The C4 appeared to be quite unchanged by the ISAT/B cycling.

See table No 2 for further details.

(d) Trial No 1/4. Handling after 6 months ISAT/B at temps. between -65° and +160° F.

Trial No 1/2 was repeated with the ISAT treated explosives at various temperatures between -65° and +160° F.

Below 0° F. only the C4 was useable as a plastic. There was nothing to choose between DG 20 and DG 29 whilst PE 3A could only be moulded above 100° F.

Full results are given in Table No. 2.

(e) Trial No 2/1. Slumping at high temperatures of new explosives.

Blocks of each explosive 2" x 2" x 10" were stood on end on a steel plate with one 2" x 10" face in contact with a vertical steel plate. The temperature of the plate assembly was raised in an electrically heated oven and measurements of temperature and slump were taken at half-hourly intervals. Photograph No 1 shows the set up of the four slabs in the oven.

A confirmatory test was carried out by warming up the slabs to 160° in a horizontal position before upending them. After a further 2 hours in the vertical position the back support was removed.

Actual slumps at temperatures up to 180° F. are recorded in Table 3.

All four explosives met the requirement that the block should not slump more than 1/2" in 1 hour when supported in the manner described.

On removal of the back support the C4 block collapsed; the DG 20 and DG 29 retained their shape with practically no slump, whilst the PE 3A gradually slumped about 1/4" per hour.

(f) Trial No 2/2. Slumping at high temperatures of ISAT treated explosive.

Trial No 2/1 was repeated with the ISAT treated explosives.

After 3 hours exposure to a temperature of 160° F. not one of the blocks slumped more than 1/8".

(g) Trial No 3/1. Sensitivity of new PE, earth backed, to Ball Ammunition.

At a range of 100 yds. .303 ball was fired at a target of explosive 2" thick contained in a box open top and bottom and backed with earth filled sandbags. The set up is shown in Photo. No. 3.

A total of 50 shots was fired at each type of explosive.

Table No 4 in Appendix 1 gives detailed results, and Photo No 4 shows the typical effect of hitting a target.

All four explosives withstood 50 shots without exploding or bursting into flame.

The C4 showed greater tendency to break up, otherwise there was no difference in behaviour when these explosives were hit by .303 ball ammunition.

(h) Trial No 3/2. Sensitivity of new PE, steel backed, to Ball.

Trial 3/1 was repeated but with the target clamped firmly to a 1/2" thick steel plate, as shown in Photo No 2.

Table No 5 in Appendix 1 gives detailed results:-

PE 3A. 11 out of 50 hits (22%) caused burning after an interval of between 0 and 2 seconds.
DG 20. 8 out of 50 hits (16%) caused burning after 0 to 1 sec.
DG 29. 1 out of 50 hits (2%) caused burning after a 10 sec. interval.
C4. 26 out of 50 hits (52%) caused burning after 0 to 12 secs.

(i) Trial No 5/3. Sensitivity of ISAT treated PE, steel backed, to Ball.

Trial 3/2 was repeated using explosive which had been exposed to 6 months ISAT/B cycling.

(Note. Insufficient explosive was available to complete 50 shots on each target.)

Table No 6 in Appendix 1 gives detailed results.

PE 3A. 5 out of 19 (26%) caused burning in 0 to 3 seconds.
DG 20. 4 out of 47 (8½%) caused burning in 0 to 1 sec.
DG 29. 2 out of 44 (4½%) caused immediate burning.
C4. 6 out of 10 (60%) caused burning in 0 to 5 secs.

(j) Trial No 3/4. Sensitivity of new PE, earth backed, to Tracer.

Trial 3/1 was repeated but in this case S.A. Tracer .303 G Mk. 6 was used.

Table 7 in Appendix 1 gives detailed results.

All four explosives withstood 50 hits without exploding or bursting into flame.

(k) Trial No 3/5. Sensitivity of new PE, steel backed, to Tracer.

Trial 3/4 was repeated but with the target clamped to a ½" thick steel plate. Five targets of each type of explosive were fired at.

The first hit on target caused immediate burning in every case.

(l) Trial No 4/1. Initiation by No 27 Det. at normal temperature.

A.M.S. witness plate 16" x 12" x 5/16" thick was set up with each end supported on firm steel baulks 12" apart. An 8 oz. cartridge of P.E. was placed in the centre and initiated at one end with a No 27 detonator. Photo No 5 shows the charge ready for firing. The witness plate was weighed before and after firing and the amount of damage recorded. Each type of P.E. was fired 10 times.

(Note. ½" plate as called for was not available so 5/16" plate was used.)

Table No 8 of Appendix 1 records results.

Photographs 6 to 9 show typical damage to the witness plates.

There was no appreciable difference in the noise or smoke produced by each explosion, therefore it was concluded that complete detonation occurred in each case. There was a slight apparent difference in the power of the explosions as follows:-

PE 3A	gave	10/10	good	outs.
DG 20	"	10/10	"	"
DG 29	"	7/10	"	"
C4	"	7/10	"	"

(m) Trial No 4/2. Initiation by XIE1 Det. at normal temperature.

Trial 4/1 was repeated but using an XIE1 detonator. The first 5 tests were carried out on 5/16" plate and a further 5 tests of each were done on 1½" thick plate of Brinell hardness between 145 & 175.

(Note. A quantity of 1½" plate was available whereas 5/16" plate was in short supply.)

Table No 9 of Appendix 1 records results.

Complete detonation occurred in every instance. Cutting effects were as follows:-

PE 3A	gave	8/10	good	outs
DG 20	"	7/10	"	"
DG 29	"	8/10	"	"
C4	"	4/10	"	"

(n) Trial No 4/3. Initiation by U.S.A. Det. at normal temperature.

Trial 4/2 was repeated but using a U.S.A. non-electric detonator.

Table No 10 of Appendix 1 records results.

Complete detonation occurred in every instance. Cutting effects were as follows:-

PE 3A	gave	8/10	good cuts
DG 20	"	8/10	" "
DG 29	"	6/10	" "
C4	"	4/10	" "

(Note. The lower cutting power of C4 in this type of trial may be due to its lower density or to the fact that cartridges were hand made instead of being machine rolled.)

(o) Trial No 5/1. Initiation by Detonating Cord at normal temperature.

A witness plate was set up as in Trial 4/2 with an 8 oz. cartridge in the middle of the plate. Initiation was done from a short length of detonating cord with a single thumb knot embedded in the middle of the cartridge.

Photo. No 10 shows the charge on a 1½" witness plate before firing and Photo. No 11 shows the cut plate after firing.

Table No 11 in Appendix 1 gives detailed results.

PE 3A	gave	10/10	good cuts
DG 20	"	9/10	" "
DG 29	"	8/10	" "
C4	"	4/10	" "

Detonation appeared to be complete in every case.

(p) Trial No 5/2. Initiation by Detonating Cord at +160° F.

Trial 5/1 was repeated with the explosive at a temperature of 160° F.

Table No 12 in Appendix 1 gives detailed results.

PE 3A	gave	6/10	good cuts
DG 20	"	8/10	" "
DG 29	"	8/10	" "
C4	"	3/10	" "

Detonation appeared to be complete in every case.

(q) Trial No 6/1. Propagation at normal temperature.

A train of nine wrapped P.E. cartridges, placed end to end as close as possible, was put on a ½" thick M.S. witness plate supported on level sand. One end was initiated with a No 27 detonator and note was taken of the effect of the explosion along the plate.

Photographs 12, 13 & 14 show the arrangement before and after detonation.

Table No 13 in Appendix 1 gives detailed results.

PE 3A, DG 20 & DG 29 propagated satisfactorily at first attempt.

C4 gave not nearly such a powerful detonation and the explosion tended to fade out. The use of an RE1 detonator to initiate showed no improvement.

(r) Trial No 6/2. Propagation at -65° F.

Trial 6/1 was repeated with the cartridges redueed to -65° F. The witness plate was retained at normal temperature to ensure a true oomparison of propagation effects at low and normal temperatures.

All explosives gave a good cut of the witness plate all along the line; there was no indication of any falling off in power.

(s) Trial No 6/3. Propagation at +160°F.

Trial 6/1 was repeated with P.E. eartridges at +160° F.

All four explosives propagated with no falling off in power throughout the 9 cartridges and the out made in the plate was in every case slightly more pronounced than when the same test was done with the explosive at normal temperature.

The C4 caused much greater bending of the plate than the other three, indieating more of a pushing than cutting effect. This may have been due to the less density of this P.E. making its explosion centre a trifle more distant from the witness plate.

(t) Trial No 7/1. Steel Cutting at normal temperatures of new explosive.

An M.S. witness plate 16" x 12" x $1\frac{1}{2}$" was placed on firm supports 12" apart and a weighed quantity of explosive was moulded in semi-circular eross seetion aeross the full 12" width of the plate. It was detonated with an XIE1 detonator from the centre. The experiment was repeated with gradually inereasing weights of explosive until the plate was cut 3 times in suceession.
Photo No 15 shows the wood mould used together with a eharge ready for detonation.

Table No 14 of Appendix 1 gives detailed results.

PE 3A required 9 ozs per foot run for 3 eonseoutive cuts.
DG 20 } each required 10 ozs.
DG 29 }
C4 required 9 ozs.

Photograph No 16 shows the $1\frac{1}{2}$" witness plate after being cut by 10 ozs of DG 29.

(u) Trial No 7/2. Steel Cutting at normal temperature after 6 months IS/T/B cycling.

Trial 7/1 was repeated with the explosives which had been exposed to 6 months IS/T/B cycling.

Owing to shortage of M.S. plate this test was done on plates of lesser strength than those used in the previous trial. (Brinell hardness 155/145 instead of 145/175).

Table No 15 gives detailed results.

PE 3A	required	8	ozs	for	5 cuts
DG 20	"	8	"	"	" "
DG 29	"	9	"	"	" "
C4	"	9	"	"	" "

(v) Trial No 7/3. Steel Cutting at -60° F. of new explosive.

Trial 7/1 was repeated with the explosive at -60° F.

Table No 16 gives detailed results.

PE 3A	required	8	ozs	for	3 cuts
DG 20	"	8	"	"	" "
DG 29	"	9	"	"	" "
C4	"	9	"	"	" "

(w) Trial No 7/4. Steel cutting at +165°F. of new explosive.

Trial 7/1 was repeated with the explosive at +165° F.

Table No 17 gives detailed results.

PE 3A	required	8	ozs for	3 cuts
DG 20	"	7	"	"
DG 29	"	7	"	"
C4	"	8	"	"

(x) Trial No 7/5. Steel cutting after submersion in water.

Semi circular charges of unwrapped explosive were submerged in sea water at 18' head. After 7 days they were taken out and exploded on a witness plate as in trial 7/1.

Table No 18 gives detailed results.

PE 3A	required	9	ozs for	3 cuts
DG 20	"	10	"	"
DG 29	"	9	"	"
C4	"	10	"	"

7. SUMMARY OF RESULTS.

(a) Handling Properties. (Trials 1/1, 1/2, 1/3, & 1/4)

(i) New Explosive.

At normal temperatures (40° to 60° F.) DG 20 and DG 29 showed a marked superiority over PE3A and C4 as regards stickiness and cleanliness of handling. At low English winter temperatures the DG 29 had the advantage in being rather more plastic whilst at summer temperatures it got slightly sticky but this was no great disadvantage. The cohesion of DG 20 and DG 29 equalled that of PE 3A and was much better than that of C4.

At low temperatures (0° to -65° F.)

PE 3A became unworkable below 0° F.
DG 20 was just workable at -65° F.
DG 29 " " " " -40° F.
C4 was quite plastic at -65° F. but lacked cohesion.

At high temperatures (120° to 160° F.) DG 20 and DG 29 became only slightly softer and were still quite easy to mould and handle generally. PE 3A became very sticky and extremely dirty whilst C4 became quite impossible to handle.

(ii) Explosive after ISAT/B cycling. After ISAT/B cycling for 6 months

PE 3A	was useable as a plastic only					between	100° F. and +160° F.
DG 20	"	"	"	"	"	"	0° F. and +160° F.
DG 29	"	"	"	"	"	"	0° F. and +160° F.
C4	"	"	"	"	"	"	-65°F. and +100° F.

None of these explosives caused headache or any skin irritation.

(b) Slumping at high temperatures (Trials 2/1 and 2/2)

(i) New PE 3A, DG 20 and DG 29 were subject to a small initial slump when shaped to a mould and heated but this slump did not appreciably increase up to a temperature of +160° F. The amount of slump of DG 29 was equal to that of PE 3A and a trifle less than that of DG 20.

C4 showed no slump at all up to a temperature of 160° F. when supported by a back plate but collapsed completely when the back support was removed.

(ii) The ISAT treated explosives slumped even less than the new explosives.

(c) Sensitivity to S.A.A. (Trials 3/1, 3/2, 3/3, 3/4 and 3/5)

(i) New Explosive.

When backed by earth and subject to hits by .303 ammunition, either Ball or Tracer, not one of the explosives burned or detonated.

When backed by steel plate and hit with .303 Ball the PE 3A burst into flame after between 1 and 10 hits. The DG 20 was a trifle less sensitive, the DG 29 was considerably less sensitive whist the C4 almost invariably started burning after 1 or 2 shots.

When backed by steel plate and hit with .303 Tracer all these explosives burst into flame immediately upon being hit.

(ii) ISAT Treated explosive.

The sensitivity of all four explosives to ball ammunition was not appreciably affected by the ISAT cycling.

(d) Initiation (Trials 4/1, 4/2, 4/3, 5/1 and 5/2)

All explosives were completely detonated when initiated by No. 27, XlEl and U.S.A. non-electric detonators at normal temperatures.

All were detonated by a single thumb knot in Detonating Cord Mark 2 at both normal and high (+160° F.) temperatures.

(e) Propagation. (Trials 6/1, 6/2 and 6/3)

At normal temperatures PE 3A, DG 20 and DG 29 gave satisfactory propagation from a No. 27 Detonator, but the detonation of C4 tended to fade out and showed no improvement when an XlEl Detonator was used.

At -65° F. all four explosives propagated from a No. 27 Detonator without fading.

At +160° F. all four explosives gave satisfactory propagation from a No. 27 Detonator.

(f) Steel Cutting. (Trials 7/1, 7/2, 7/3, 7/4 and 7/5)

There was no appreciable difference in the cutting power of the four explosives. All required between 7 and 10 ozs. to cut a 12" wide $1\frac{1}{2}$" M.S. plate 3 times in succession. The different weights are accounted for by the difficulty of exact control of field experiments of this nature (solidity and distance apart of supports, target variations, contact of explosive, errors of shape and weight, etc.) and the variation which is normal to explosive charges.

Submersion for 7 days under an 18' head of seawater had no effect on the cutting power.

The ISAT cycling did not cause falling off of cutting power of any of the explosives.

8. CONCLUSIONS

A table showing the extent of which DG 20 and DG 29 meet the W.O. Military Characteristics is given at Appendix 2. Both explosives comply with requirements in all trials covered by this report except that they deteriorate in storage and are not easily moulded below -20° F. although DG 29 can be moulded with difficulty down to -40° F. and DG 20 can be moulded with difficulty down to -65° F.

Both explosives show an improvement over PE 3A in their handling properties and liability to ignite from SAA fire and in all other respects investigated in these trials they are as good as PE 3A.

There is nothing to choose between DG 20 and DG 29 apart from the slightly greater sensitivity to SAA fire and the better moulding power of DG 20 at extremely low temperatures.

It is considered that the plasticity of both these explosives is just about right for use at normal temperatures.

C4 is easier to handle at very low temperatures (-20° F. to -60° F.) than DG 20 and DG 29 and appears to be less affected by storage, but at normal and high temperatures it is less easy to handle. C4 does not appear to have quite such good steel cutting properties as the British Explosives and it is more easily ignited by SAA fire.

TABLE NO. 1

APPENDIX 1

HANDLING PROPERTIES OF EXPLOSIVES WHEN ISSUED NEW

Trials 1/1 & 1/2

Temperature (°F.)	PE 3A	DG 20	DG 29	C4
- 65	Solid	Very hard but just workable under hand pressure. Rectifier makes hole without difficulty. Cohesion poorer than at normal temperature but adequate.	Solid	Easily moulded. Plasticity unchanged from that at normal temperature. Cohesion poor. Almost impossible to knit two cartridges together.
- 40	"	Hard but just workable. Cohesion less than normal but adequate.	Very hard but just workable. Cohesion adequate.	"
- 20	"	Harder than normal but easily moulded with adequate cohesion. More crumbly than DG 29.	Much harder than normal but easily moulded. Good cohesion.	"
0	Just workable under hand pressure. Cohesion fair. Inclined to crumble.	Slightly less plastic than normal, but adequate. Cohesion good.	Slightly less plastic than normal, but adequate. Cohesion good.	Easily worked to shape and pressed into a mould. Poor cohesion. Two cartridges not easily joined together.
Normal + 40 to 60	Easily worked to shape or pressed into a mould. Good cohesion with no crumbling. Sticks to fingers when handled.	Easily worked to shape or pressed into a mould. Good cohesion. Not sticky.	Softer and rather more easily worked than PE 3A or DG 20. Excellent cohesion. Inclined to get sticky when handled.	Easily moulded. Adequate cohesion. Sticky to handle.
+ 100	More easily moulded with good cohesion, but more sticky than at normal temperature.	Plasticity and cohesion unchanged from normal. Not sticky.	Plasticity and cohesion unchanged from normal. Very slightly sticky.	Easily moulded. Poor cohesion. Very sticky to handle.
+ 140	Very easily moulded but extremely sticky.	A trifle softer than normal. Not sticky.	A trifle softer than normal. Slightly sticky.	Very plastic but extremely sticky and lacking all cohesion.
+ 160	"	"	"	No longer workable but falls apart into a sticky mass when handled.

APPENDIX 1

TABLE NO. 2

HANDLING PROPERTIES OF EXPLOSIVES AFTER 6 MONTHS ISAT/B

Trials 1/3 & 1/4

Temp. °F.	PE 3A	DG 20	DG 29	C4
-65	Solid	Solid	Solid	Handling properties apparently quite unchanged by ISAT treatment. (See Table No. 1)
-40	"	Very hard and not mouldable.	Very hard and not mouldable.	
-20	"	Hard and crumbly. Not mouldable.	"	
0	Very hard. Not mouldable under hand pressure. Very crumbly.	Just mouldable. Cohesion poor. Inclined to crumble.	Just mouldable. Cohesion poor. Inclined to crumble.	
Normal +40 to +60	Hard. Not mouldable under hand pressure. Cohesion very poor.	Slightly harder and more crumbly than before ISAT. Easily moulded. Cohesion adequate.	Each cartridge had a hard crust, but after working in the hand it became soft and just right for moulding with adequate cohesion.	
+100	Mouldable with difficulty. Cohesion insufficient to prevent crumbling.	Easily mouldable with adequate cohesion.	Easily mouldable with adequate cohesion.	
+140	"	"	"	
+180	"	"	"	

APPENDIX 1

TABLE NO. 3

SLUMPING AT HIGH TEMPERATURES

Trial 2/1

Time	Average Temp. of Slab (°F.)	Slump (in.)			
		PE 3A	DG 20	DG 29	C4
1st Test					
1000	45	0	0	0	0
1030	110	3/4	3/8	1/2	"
1100	132	"	"	"	"
1130	155	7/8	"	5/8	"
1200	161	1	1/2	3/4	"
1230	162	"	"	"	"
1300	170	"	"	"	"
1330	176	"	"	"	"
1400	180	"	"	"	"
1430	180	"	"	"	"
1500	180	"	"	"	"
2nd Test					
1100	40	Blocks were retained in the horizontal position during this warming-up period.			
1130	102				
1200	151				
1200	151	1/8	0	1/8	0
1230	159	1/4	1/8	1/4	1/8
1300	161	"	"	"	"
1330	161	"	"	"	"
1400	163	"	"	"	"
	At this point the back support for the blocks was removed. The C4 block collapsed.				
1400	163	7/8	3/8	1	-
1430	163	1	"	1 1/8	-
1500	163	1 1/8	"	"	-

APPENDIX 1

TABLE NO. 4

SENSITIVITY OF EARTH BACKED P.E. TO BALL AMMUNITION

Trial 3/1

Explosive	Target No.	No. of Shots	Result
PE 3A	1	11	No burning or explosion
	2	7	" " " "
	3	7	" " " "
	4	8	" " " "
	5	9	" " " "
	6	8	" " " "
DG 20	7	7	" " " "
	8	6	" " " "
	9	8	" " " "
	10	9	" " " "
	11	5	" " " "
	12	7	" " " "
	13	8	" " " "
DG 29	14	7	" " " "
	15	5	" " " "
	16	7	" " " "
	17	4	" " " "
	18	11	" " " "
	19	6	" " " "
	20	10	" " " "
C4	21	3	" " " "
	22	7	" " " "
	23	5	" " " "
	24	4	" " " "
	25	5	" " " "
	26	5	" " " "
	27	5	" " " "
	28	6	" " " "
	29	5	" " " "
	30	5	" " " "

APPENDIX 1

TABLE NO. 5

SENSITIVITY OF STEEL BACKED P.E. TO BALL AMMUNITION.

Trial 3/2

Explosive	Target No.	No. of Shots	Result
PE 3A	1	10	Burnt after 2 secs.
	2	2	" " 0 "
	3	5	" " 0 "
	4	1	" " 2 "
	5	4	" " 1 "
	6	7	" " 2 "
	7	9	" " 0 "
	8	7	" " 0 "
	9	1	" " 0 "
	10	3	" " 1 "
	11	1	" " 0 "
DG 20	12	11	" " 1 "
	13	3	" " 0 "
	14	3	" " 0 "
	15	2	" " 0 "
	16	1	" " 0 "
	17	2	" " 1 "
	18	3	" " 0 "
	19	11	" " 0 "
	20	14	Target scattered. No burning.
DG 29	21	15	Scattered. No burning.
	22	11	Burnt after 10 secs.
	23	15	Scattered. No burning.
	24	9	" "
C4	25	1	Burnt after 1 sec.
	26	2	" " 8 "
	27	2	" " 2 "
	28	2	" " 1 "
	29	1	" " 0 "
	30	1	" " 1 "
	31	1	" " 0 "
	32	2	" " 12 "
	33	11	" " 3 "
	34	3	" " 0 "
	35	1	" " 0 "
	36	2	" " 0 "
	37	3	" " 0 "
	38	2	" " 0 "
	39	1	" " 0 "
	40	1	" " 0 "
	41	1	" " 0 "
	42	1	" " 0 "
	43	2	" " 0 "
	44	1	" " 0 "
	45	1	" " 0 "
	46	1	" " 12 "
	47	3	" " 0 "
	48	1	" " 4 "
	49	2	" " 0 "
	50	1	" " 0 "

APPENDIX 1

TABLE NO. 6

SENSITIVITY OF STEEL BACKED P.E. AFTER 6 MONTHS IS.T/B CYCLING TO BALL AMMUNITION.

Trial 3/3

Explosive	Target No.	No. of Shots	Result
PE 3A	1	9	Burnt after 0 secs.
	2	1	" " 3 "
	3	1	" " 0 "
	4	1	" " 1 "
	5	7	" " 1 "
DG 20	6	13	" " 0 "
	7	20	" " 0 "
	8	8	" " 0 "
	9	1	" " 1 "
	10	5	Target scattered
DG 29	11	14	Burnt after 0 secs.
	12	29	" " 0 "
	13	1	Target scattered
C4	14	3	Burnt after 5 secs.
	15	1	" " 0 "
	16	1	" " 2 "
	17	1	" " 0 "
	18	2	" " 0 "
	19	2	" " 1 "

APPENDIX 1

TABLE NO. 7

SENSITIVITY OF EARTH BACKED P.E. TO .303 TRACER.

Trial 3/4

Explosive	Target No.	No. of Shots	Result
PE 3A	1	10	No burning or explosion
	2	13	" "
	3	7	" "
	4	8	" "
	5	12	" "
DG 20	6	9	" "
	7	16	" "
	8	6	" "
	9	10	" "
	10	9	" "
DG 29	11	10	" "
	12	15	" "
	13	10	" "
	14	6	" "
	15	9	" "
C4	16	7	" "
	17	8	" "
	18	6	" "
	19	17	" "
	20	12	" "

APPENDIX 1

TABLE NO. 8

INITIATION BY NO. 27 DETONATOR AT NORMAL TEMPERATURE (40° to 50° F)

Trial 4/1

Serial No.	Type of Explosive	Weight of metal removed	Result	Estimated power of explosion
1	PE 3A	32 ozs.	Plate holed	Good
2		32 "	Plate holed and broken	Good
3		44 "	" " " "	Good
4		40 "	Plate holed	Good
5		44 "	Plate holed and torn	Good
6		32 "	" " " "	Good
7		44 "	Plate holed and broken	Good
8		36 "	Plate holed	Good
9		28 "	Plate holed and torn	Good
10		36 "	Plate holed	Good
		Average 36.8 ozs.		
11	DG 20	36 ozs.	Plate holed and torn	Good
12		32 "	" " " "	Good
13		32 "	" " " "	Good
14		36 "	" " " "	Good
15		28 "	" " " "	Good
16		32 "	" " " "	Good
17		28 "	" " " "	Good
18		32 "	" " " "	Good
19		24 "	" " " "	Good
20		24 "	" " " "	Good
		Average 30.4 ozs.		
21	DG 29	36 ozs.	Plate holed and torn	Good
22		16 "	Plate torn	Medium
23		16 "	" "	Medium
24		4 "	" "	Medium
25		28 "	Plate holed and torn	Good
26		32 "	Plate holed and torn	Good
27		28 "	" " " "	Good
28		28 "	" " " "	Good
29		32 "	" " " "	Good
30		36 "	" " " "	Good
		Average 25.6 ozs.		
31	C4	56 ozs.	Plate holed and broken	Good
32		28 "	" " " "	Good
33		0 "	Plate torn	Bad
34		48 "	Plate holed and broken	Good
35		48 "	Plate holed	Good
36		28 "	" "	Good
37		4 "	Plate torn and broken	Medium
38		40 "	Plate holed	Good
39		0 "	Plate torn	Bad
40		24 "	Plate holed	Good
		Average 27.6 ozs.		

APPENDIX 1

TABLE NO. 9

INITIATION BY XIEI DETONATOR
AT NORMAL TEMPERATURE (40 - 50° F)

Trial 4/2

Serial No.	Type of explosive	Witness Plate	Wt. of metal removed	Effect on Plate	Estimated power of explosion
1		16 x 12 x 5/16"	52 ozs.	Holed and broken	Good
2		"	4 "	Torn	Medium
3		"	27 "	Holed and broken	Good
4	PE 3A	"	33 "	Holed and torn	Good
5		"	49 "	"	Good
6		12 x 8 x 1½"	-	Cut	Good
7		"	-	"	Good
8		"	-	"	Good
9		"	-	Nearly cut	Medium
10		"	-	Cut	Good
11		16 x 12 x 5/16"	32 ozs.	Holed and torn	Good
12		"	30 "	Holed and bent	Good
13		"	36 "	Holed and torn	Good
14	DG 20	"	4 "	Torn	Medium
15		"	46 "	Holed and bent	Good
16		12 x 8 x 1½"	-	Cut	Good
17		"	-	Nearly cut	Medium
18		"	-	Cut	Good
19		"	-	Nearly cut	Medium
20		"	-	Cut	Good
21		16 x 12 x 5/16"	32 ozs.	Holed	Good
22		"	30 "	"	Good
23		"	58 "	Holed and broken	Good
24	DG 29	"	32 "	Holed and bent	Good
25		"	48 "	" "	Good
26		12 x 8 x 1½"	-	Cut	Good
28		"	-	Nearly cut	Medium
29		"	-	Cut	Good
30		"	-	Nearly cut	Medium
31		16 x 12 x 5/16"	0 ozs.	Torn and bent	Bad
32		"	0 "	" "	Bad
33		"	30 "	Holed and broken	Good
34	C4	"	23 "	Holed and torn	Good
35		"	0 "	Torn	Bad
36		12 x 8 x 1½"	-	Cut	Good
37		"	-	Cut	Good
38		"	-	Dented only	Bad
39		"	-	" "	Bad
40		"	-	" "	Bad

APPENDIX 1

TABLE NO. 10

INITIATION BY USA DETONATOR
AT NORMAL TEMP. (40 - 50° F)

Trial 4/3

Serial No.	Type of Explosive	Witness Plate	Wt. of metal removed	Effect on plate	Estimated power of explosion
1		16 x 12 x 5/16"	57 ozs.	Holed	Good
2		"	50 "	"	Good
3		"	41 "	"	Good
4		"	67 "	Holed and broken	Good
5	PE 3A	"	1 "	Torn	Bad
6		12 x 8 x 1½"	-	Cut	Good
7		"	-	"	Good
8		"	-	"	Good
9		"	-	Nearly cut	Medium
10		"	-	Cut	Good
11		16 x 12 x 5/16"	63 ozs.	Holed and broken	Good
12		"	40 "	Holed	Good
13		"	46 "	"	Good
14		"	41 "	"	Good
15	DG 20	"	28 "	Holed and torn	Good
16		12 x 8 x 1½"	-	Just cracked	Medium
17		"	-	Cut	Good
18		"	-	Cut	Good
19		"	-	Nearly cut	Medium
20		"	-	Cut	Good
21		16 x 12 x 5/16"	46 ozs.	Holed	Good
22		"	45 "	Holed and broken	Good
23		"	45 "	" "	Good
24		"	42 "	Holed	Good
25	DG 29	"	1 "	Torn	Bad
26		12 x 8 x 1½"	-	Cut	Good
27		"	-	Cut	Good
28		"	-	Dented only	Bad
29		"	-	Nearly cut	Medium
30		"	-	Dented only	Bad
31		16 x 12 x 5/16"	39 ozs.	Holed	Good
32		"	2 "	Torn and broken	Bad
33		"	0 "	Torn	Bad
34		"	1 "	Torn and broken	Bad
35	C4	"	24 "	" "	Medium
36		12 x 8 x 1½"	-	Cut	Good
37		"	-	Barely marked	Bad
38		"	-	Cut	Good
39		"	-	"	Good
40		"	-	Barely marked	Bad

APPENDIX 1

TABLE NO. 11

INITIATION BY DETONATOR CORD
AT NORMAL TEMP. (40 - 50° F)

Trial 5/1

Serial No.	Type of explosive	Witness Plate	Wt. of metal removed	Effect on Plate	Estimated power of explosion
1		16 x 12 x 5/16"	37 ozs.	Holed and torn	Good
2		"	42 "	Holed	Good
3		"	19 "	Holed and torn	Good
4		"	23 "	" "	Good
5	PE 3A	"	49 "	Holed	Good
6		12 x 8 x 1½"	-	Cut	Good
7		"	-	"	Good
8		"	-	"	Good
9		"	-	"	Good
10		"	-	"	Good
11		16 x 12 x 5/16"	28 ozs.	Holed	Good
12		"	21 "	"	Good
13		"	30 "	"	Good
14		"	41 "	"	Good
15	DG 20	"	16 "	"	Good
16		12 x 8 x 1½"	-	Dented with scab	Medium
17		"	-	Cut	Good
18		"	-	"	Good
19		"	-	"	Good
20		"	-	"	Good
21		16 x 12 x 5/16"	32 ozs.	Holed	Good
22		"	22 "	"	Good
23		"	51 "	"	Good
24		"	28 "	"	Good
25	DG 29	"	23 "	"	Good
26		12 x 8 x 1½"	-	Cut	Good
27		"	-	"	Good
28		"	-	Dented with scab	Medium
29		"	-	" " "	Medium
30		"	-	Cut	Good
31		16 x 12 x 5/16"	21 ozs.	Holed	Good
32		"	3 "	Torn and bent	Bad
33		"	6 "	" "	Medium
34		"	1 "	" "	Bad
35	C4	"	44 "	Holed	Good
36		12 x 8 x 1½"	-	Cut	Good
37		"	-	Dented only	Bad
38		"	-	Cut	Good
39		"	-	Nearly cut	Medium
40		"	-	" "	Medium

APPENDIX 1

TABLE NO. 12

INITIATION BY DETONATING CORD AT +160° F.

Trial 5/2

Serial No.	Type of explosive	Witness Plate	Wt. of metal removed	Effect on Plate	Estimated power of explosion
1		16 x 12 x 5/16"	28 ozs.	Holed and torn	Good
2		"	32 "	"	Good
3		"	19 "	"	Good
4		"	31 "	"	Good
5	RE 34	"	47 "	"	Good
6		12 x 8 x 1½"	-	Barely dented	Bad
7		"	-	"	Medium
8		"	-	Nearly out	Medium
9		"	-	Cut	Good
10		"	-	Nearly cut	Medium
11		16 x 12 x 5/16"	27 ozs.	Holed and torn	Good
12		"	15 "	"	Good
13		"	37 "	Holed	Good
14		"	25 "	"	Good
15	DG 20	"	20 "	Holed and torn	Good
16		12 x 8 x 1½"	-	Cut	Good
17		"	-	Cut	Good
18		"	-	Dented only	Bad
19		"	-	Nearly out	Medium
20		"	-	Cut	Good
21		16 x 12 x 5/16"	28 ozs.	Holed and torn	Good
22		"	29 ozs.	Holed	Good
23		"	40 "	"	Good
24		"	31 "	"	Good
25	DG 29	"	19 "	"	Good
26		12 x 8 x 1½"	-	Cut	Good
27		"	-	Cut	Good
28		"	-	Nearly out	Medium
29		"	-	Cut	Good
30		"	-	Nearly out	Medium
31		16 x 12 x 5/16"	34 ozs.	Holed and torn	Good
32		"	3 "	Torn and bent	Bad
33		"	2 "	Torn and broken	Medium
34		"	4 "	"	
35	C4	"	1 "	Torn and bent	Bad
36		12 x 8 x 1½"	-	Barely dented	Bad
37		"	-	Cut	Good
38		"	-	Cut	Good
39		"	-	Barely dented	Bad
40		"	-	Nearly out	Medium

APPENDIX 1

TABLE NO. 13

PROPAGATION AT NORMAL TEMP. (45° F) USING NO. 27 DETONATOR

Trial 6/1

Serial No.	Type of P.E.	Result
1	PE 3A	Good cut of equal size along whole length
2	DG 20	" " " " " " " "
3	DG 29	" " " " " " " "
4	C4	Just cut under 1st 3 cartridges. Completely cut under centre 3 cartridges. Uncut with definite indication of fade out under last 3 cartridges.
5	C4	Just cut under 1st cartridge only. Remainder only dented plate with slightly less dent under last 2 cartridges.
6	C4	Not cut through anywhere but no evidence of fading out.
The trial of C4 was repeated, using an X1E1 detonator.		
7	C4	Well cut under 1st 2 cartridges. Just cut under next 5 cartridges. Not cut under last 2 cartridges.

APPENDIX 1

TABLE NO. 14

STEEL CUTTING AT NORMAL TEMP. (40° F)
OF NEW EXPLOSIVE

Trial 7/1

Serial No.	Type of Explosive	Weight per 12" width	Effect on 1½" plate of hardness 160 B.
1	RE 3A	8 ozs.	Failed to cut
2		9 ozs.	Cut
3		9 "	Cut
4		9 "	Cut
5	DG 20	9 ozs.	Nearly cut
6		10 "	Cut
7		10 "	Cut
8		10 "	Cut
9	DG 29	8 ozs.	Failed to cut
10		9 "	Cut
11		9 "	Cut
12		9 "	Nearly cut
13		10 "	Cut
14		10 "	Cut
15		10 "	Cut
16	C4	8 ozs.	Cut
17		8 "	Nearly cut
18		9 "	Cut
19		9 "	Cut
20		9 "	Cut

APPENDIX 1

TABLE NO. 15

STEEL CUTTING AFTER ISAT/B CYCLING

Trial 7/2

Serial No.	Type of explosive	Weight per 12" width	Effect on $1\frac{1}{2}$" plate of hardness 140 B.
1	PE 3A	8 ozs.	Cut
2		8 "	Cut
3		8 "	Cut
4		7 "	Cut
5		7 "	Failed
6	DG 20	7 ozs.	Failed
7		8 "	Cut
8		8 "	Cut
9		8 "	Cut
10	DG 29	7 ozs.	Failed
11		8 "	Cut
12		8 "	Cut
13		8 "	Failed
14		9 "	Cut
15		9 "	Cut
16		9 "	Cut
17	C4	7 ozs.	Failed
18		8 "	Cut
19		8 "	Cut
20		8 "	Failed
21		9 "	Cut
22		9 "	Cut
23		9 "	Cut

TABLE NO. 16

APPENDIX 1

STEEL CUTTING AT -65° F. OF NEW EXPLOSIVE.

Trial 7/3

Serial No.	Type of explosive	Weight per 12" width	Effect on 1½" Plate of hardness 140 B.
1	HE 3A	8 ozs.	Failed to initiate @
2		8 "	Cut
3		8 "	Cut
4		8 "	Cut
5	DG 20	8 ozs.	Cut
6		8 "	Cut
7		8 "	Cut
8	DG 29	8 ozs.	Nearly cut
9		8 "	Cut
10		8 "	Cut
11		8 "	Nearly cut
12	C4	8 ozs.	Failed to cut
13		8 "	Failed to cut
14		8 "	Failed to cut
15		9 "	Cut
16		9 "	Cut
17		9 "	Cut

@ This failure may have been due to the difficulty of getting the detonator in close contact with the P.E. which was solid at this temperature.

APPENDIX 1

TABLE NO. 17

STEEL CUTTING AT +160° F. OF NEW EXPLOSIVE

Trial 7/4

Serial No.	Type of explosive	Weight per 12" width	Effect on 1½" plate of hardness 140 B.
1	PE 3A	7 ozs.	Cut
2		7 "	Nearly cut
3		8 "	Cut
4		8 "	Cut
5		8 "	Cut
6	DG 20	6 ozs.	Failed to cut
7		7 "	Cut
8		7 "	Cut
9		7 "	Cut
10	DG 29	6 ozs.	Failed to cut
11		7 "	Cut
12		7 "	Cut
13		7 "	Cut
14	C4	7 ozs.	Failed to cut
15		8 "	Cut
16		8 "	Cut
17		8 "	Cut

APPENDIX 1

TABLE NO. 18

STEEL CUTTING AFTER SUBMERSION IN WATER

AMBIENT TEMPERATURE 45° F.

Trial 7/5

Serial No.	Type of explosive	Weight per 12" width	Effect on 1½" plate of hardness 160 B.
1		8 ozs.	Nearly cut
2	PE 3A	9 "	Cut
3		9 "	Cut
4		9 "	Cut
5		8 "	Cut
6		8 "	Cut
7		8 "	Nearly cut
8	DG 20	9 "	Cut
9		9 "	Failed to cut
10		10 "	Cut
11		10 "	Cut
12		10 "	Cut
13		8 "	Cut
14		8 "	Cut
15	DG 29	8 "	Failed to cut
16		9 "	Cut
17		9 "	Cut
18		9 "	Cut
19		8 "	Cut
20		8 "	Cut
21		8 "	Nearly cut
22	C4	9 "	Cut
23		9 "	Cut
24		9 "	Nearly cut
25		10 "	Cut
26		10 "	Cut
27		10 "	Cut

APPENDIX 2

W.O. MILITARY CHARACTERISTICS	EXTENT TO WHICH DG 20 & DG 29 COMPLY
1. Power.	1. DG 20 and DG 29 comply.
The amount of explosive required to cut M.S. plate is not to exceed the amount of PE 2 required.	(Note. PE 2 and PE 3A are of equal power)
2. Plasticity between -65 and +125° F.	
(a) Must mould easily.	(a) DG 20 moulds easily from +125° F. down to -20° F. and with difficulty down to -65° F. DG 29 easily from +125 to -20° F. and with difficulty to -40° F.
(b) A 2" thick block without container secured to a vertical target must retain its shape for 6 hours.	(b) DG 20 and 29 do not slump appreciably providing the bottom of the slab is supported.
(c) Two cartridges must form a homogeneous mass when rolled together.	(c) DG 20 cohesion satisfactory down to -65° F. DG 29 cohesion satisfactory down to -40° F. (But see para 5 below)
3 General Properties.	
(a) Must initiate by Service det. or single thumb knot of Detonating Cord.	(a) DG 20 and DG 29 comply.
(b) (i) Standard package must not be detonated or set on fire by a single round of .303 Ball or Tracer ammunition.	(b)(i) Not tested in standard package but DG 20 and DG 29 comply with this requirement when backed by earth and unconfined.
(ii) When backed by steel plate must not detonate when struck by a single round of .303 Ball or Tracer.	(ii) Both comply.
(c) (i) Must remain operative after 6 months exposure to wind and weather.	(c)(i) Both remain operative after 6 months ISAT/B cycling.
(ii) Must remain operative after 7 days immersion under 18' of sea water.	(ii) Both comply.
(d) (i) Must not cause headaches.	(d)(i) Both comply.
(ii) Must be clean to handle.	(ii) Both comply.
(iii) Must not give off toxic fumes.	(iii) Not tested.
4. Climatic Range.	
(a) Must be possible to prepare a charge between -65 and +125° F.	(a) See para 2 above.
(b) Initiation must be possible between -65° and +160° F.	(b) Both comply between -65 and +120 Not tested below - 65° but no reason to expect failure.
5. Storage Must have a life and remain safe to handle for 10 years in worst Service conditions.	Both remain operative and are safe to handle but they lose plasticity below 0° F. after 6 months ISAT/B cycling.

APPENDIX 3

COPY OF APPENDIX II TO PROC. 38,388 (SPECIAL).

MINUTES OF A MEETING HELD AT THE OFFICES OF THE ORDNANCE BOARD ON 25 NOV. 55 TO DISCUSS TRIALS OF PLASTIC EXPLOSIVES D.G.20 and D.G.29.

1. Present:-

Colonel C. O. M. Morris (O.B.) (Chairman).
Mr. H. R. Dixon (D.R.E.E.).
Lieut.-Colonel J. Lander (M.E.X.E.).
Mr. W. E. Slater (A.R.D.E.).
Lieut.-Colonel J. S. Wilkins (O.B.) (Secretary).

2. The Meeting discussed the programme of trials as suggested by M.E.X.E. in their minute 21.E.2, dated 18 Nov. 55.

The Chairman said that it might be considered necessary to submit these explosives to trials in Canada and the T.T.E. After discussions, the Meeting agreed that such trials could be considered after a final choice of explosive had been made.

The Chairman suggested that the sensitivity of these two explosives to impact by shell splinters, both with soft and steel backing, should also be tested. After discussion, it was agreed that the Board, in consultation with C.S.R., should evolve a technique and the details of trials would be worked out later. The necessity for these trials was agreed in prineiple.

Action. - Secretary.

D.R.E.E. representative said that it was most desirable to avoid initiation by primer in any of the trials arranged. The Meeting agreed.

The Meeting agreed that certain trials (to be enumerated later) should be repeated after six months I.S.A.T.(B) cycling.

D.R.E.E. representative stressed that, other things being equal, D.G.29 was preferable, the plasticiser being made of indigenous materials, whereas in D.G.20 polyisobutylene was used which might lead to import difficulties.

The Meeting noted that all P.Es. were oxygen-deficient explosives producing carbon monoxide on detonation and the War Office requirement in this respect could not be met.

D.R.E.E. representative stated that the War Office did not require troop trials of these explosives.

3. The following programme of trials was agreed to, to be carried out with D.G.20 and D.G.29 with P.E.3A as control. Similar tests will be carried out concurrently with the U.S. explosive C4.

In general, the procedure laid down in M.E.X.E. minute 21.E.2 of 18 Nov. 55 would be followed amended as shown.

(a). (i). Trial 1/1. - Handling, moulding, kneading, cohesion, cleanliness of handling and absence of obnoxious physiological effects at normal temperatures.

(ii). Trial 1/2. - Repeat of Trial 1/1 at temperatures from -65° F. to +160° F.

(iii). Trial 1/3. - Repeat Trial 1/1 after 6 months I.S.A.T.(B) cycling.

(iv). Trial 1/4. - Repeat Trial 1/2 after 6 months I.S.A.T.(B) cycling.

(b). (i). Trial 2/1. - Slumping at temperatures from +160° F. downwards.

(ii). Trial 2/2. - Repeat Trial 2/1 after 6 months I.S.A.T.(B) cycling.

Notes.

A block (dimensions 2 ins. x 2 ins. x 10 ins.) will be used standing on one 2 ins. x 2 ins. face on a steel plate with one 2 ins. x 10 ins. face in contact with a vertical steel plate. The plate assembly carrying the block of explosive will be gradually heated until the block begins to slump. The heat will then be controlled to determine the highest steady temperature at which the block does not slump more than $\frac{1}{2}$ inch in one hour.

(c). (i). Trial 3/1. - Sensitivity to ball ammunition when backed by earth.

(ii). Trial 3/2. - Sensitivity to ball ammunition when backed by steel plate.

(iii). Trial 3/3 - Repeat Trial 3/2 after 6 months I.S.A.T.(B) cycling.

(iv). Trial 3/4.- Sensitivity to tracer ammunition when backed by earth

(v). Trial 3/5.- Sensitivity to tracer ammunition when backed by steel plate.

Notes.

1. For all parts a standard target consisting of an open wooden framework filled with explosive under test dimensions 6 ins. x 6 ins. x 2 ins. deep to be used.

2. Range of attack to be 100 yards.

3. For tests 3/4 and 3/5, S.A. tracer, 0.303 inch G Mark 6 to be used.

4. For tests 3/2, 3/3 and 3/5, the target to be backed by $\frac{1}{2}$ inch M.S. plate.

5. Fifty rounds of each type of ammunition to be fired.

(d). (i). Trial 4/1. - Initiation by No. 27 detonator at normal temperature.

(ii). Trial 4/2. - Repeat Trial 4/1 using XlEl detonator at normal temperature.

(iii). Trial 4/3. - Repeat Trial 4/1 using U.S.A. non-electric detonator at normal temperatures.

Notes.

1. Charge to be fired in contact with $\frac{1}{4}$ inch M.S. witness plate.

2. Ten shots to be fired in first instance. If any failures occur, repeat until failure can be ascribed to low sensitivity of explosive and not to other causes such as a rogue detonator.

(e). (i). Trial 5/1. - Initiation by knotted detonating chord.

(ii). Trial 5/2. - Repeat Trial 5/1 at +160° F.

Notes

1. Single thumb knot embedded in the explosive to be used.

2. Charge to be fired in contact with $\frac{1}{4}$ inch M.S. witness plate.

3. Ten shots to be fired in first instance.

(f). (i). Trial 6/1. - Propagation at normal temperature using No. 27 detonator.

(ii). Trial 6/2. - Repeat Trial 6/1 at -60° F.

(iii). Trial 6/3. - Repeat Trial 6/1 at +160° F.

Notes.

1. No primers will be used.

2. A train of nine 8 oz wrapped cartridges to be used placed end-to-end as close as possible on $\frac{1}{2}$ inch M.S. witness plates, initiation to be from one end.

3. If failure occurs to detonate the whole train, repeat with higher power detonator.

(g). (i). Trial 7/1. - Steel cutting at normal temperatures.

(ii). Trial 7/2. - Repeat Trial 7/1 after 6 months I.S.A.T.(B) cycling.

(iii). Trial 7/3. - Repeat Trial 7/1 at -60° F.

(iv). Trial 7/4. - Repeat Trial 7/1 at +160° F.

(v). Trial 7/5. - Repeat Trial 7/1 after submersion for 7 days in sea water at 18 feet head.

Notes.

A M.S. witness plate 16 ins. x 12 ins. x $1\frac{1}{2}$ ins. thick will be used to determine the minimum weight of explosive required to cut it. The plate is to be placed upon firm supports 12 inches apart and a weighed quantity of explosive to be moulded in semi-circular cross-section across the full 12 inches width of the plate. It will be detonated from the centre with a XLE1 detonator without primer, the amount of explosive being gradually altered until the minimum quantity which cuts the plate three times in succession has been found.

4. The Chairman said that he would publish the War Office requirements, the correspondence which led to the meeting, and arrange trials in an Ordnance Board Proceeding.

The Meeting agreed that M.E.X.E. should start immediately on the programme of trials as agreed.

5. The Chairman said that the packaging aspect must be considered as it was desirable that packaged explosive should be submitted to I.S.A.T. cycling. He said that this aspect would be dealt with by the Board.

Action. - Secretary.

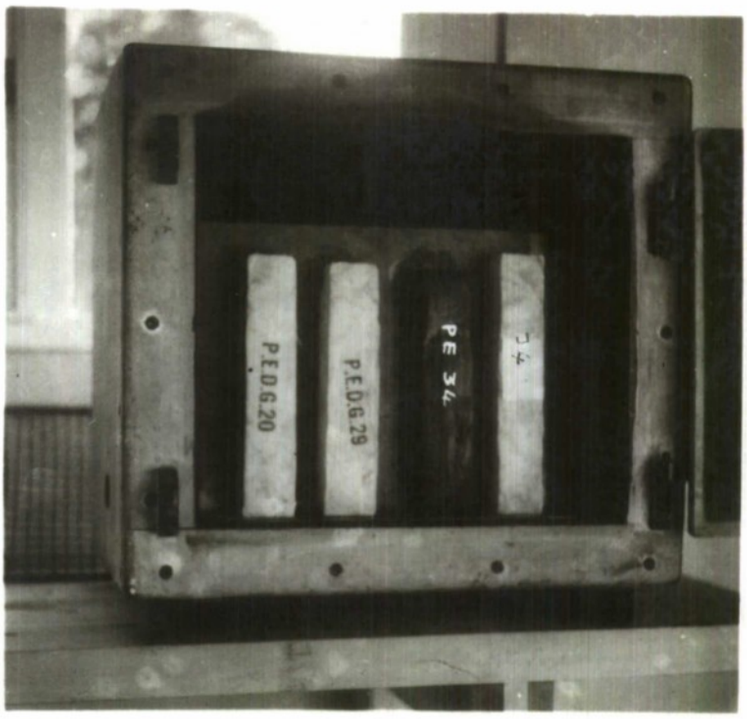


Photo No. 1. Slump test showing 4 types of P.E. in oven

Photo No. 2. Steel-backed targets for S.A.A. Sensitivity trial

Photo No. 3. Earth-backed targets for S.A.A. trial

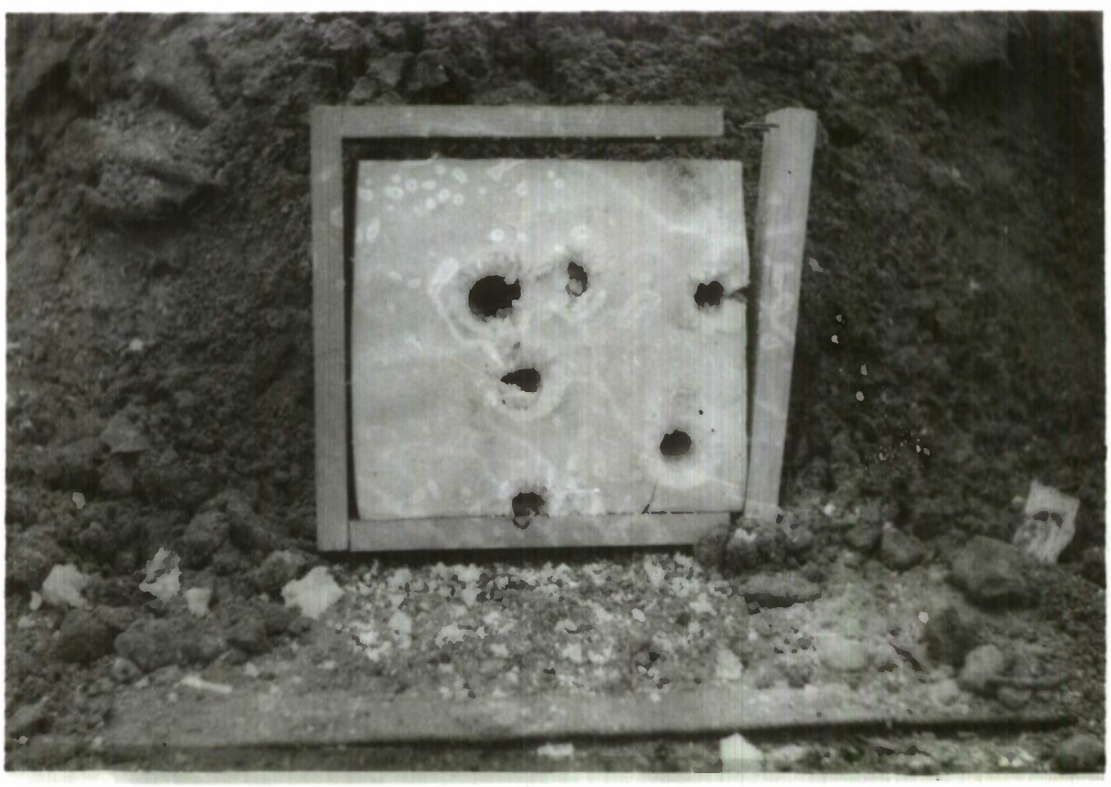


Photo No. 4. Effect of 7 rounds S.A.A. Ball on earth-backed target

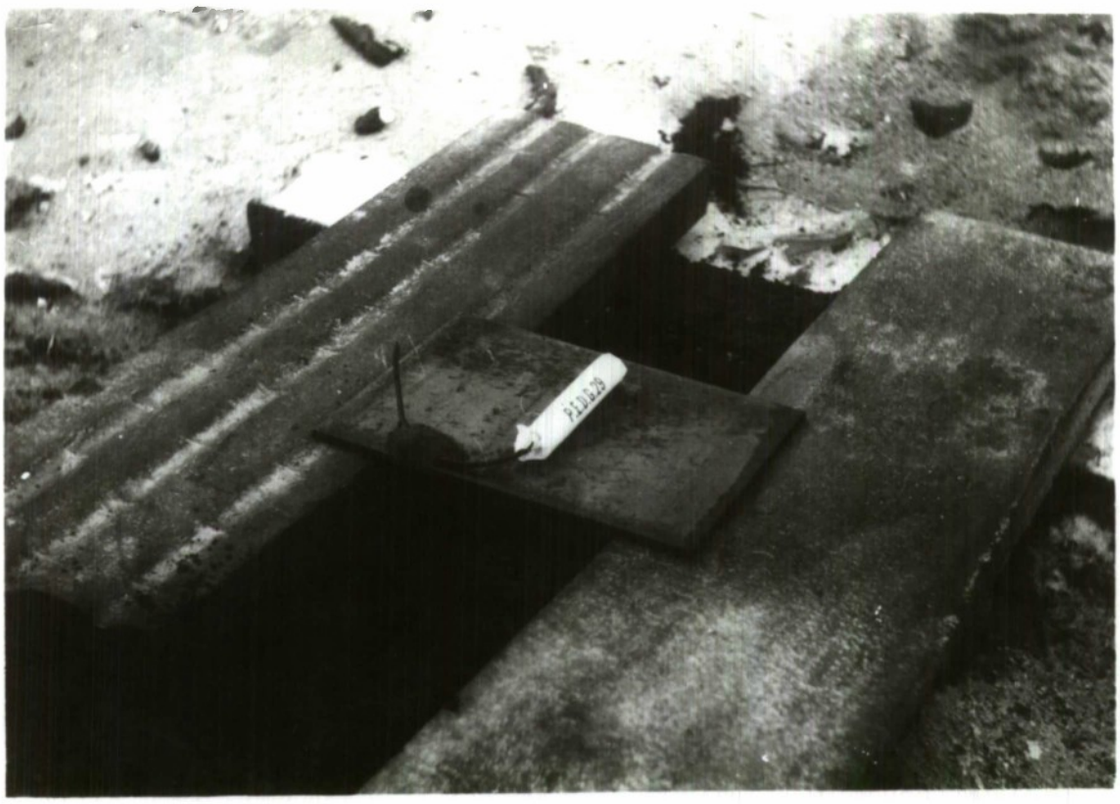


Photo No. 5. Initiation by detonator of cartridge on 5/16" witness plate

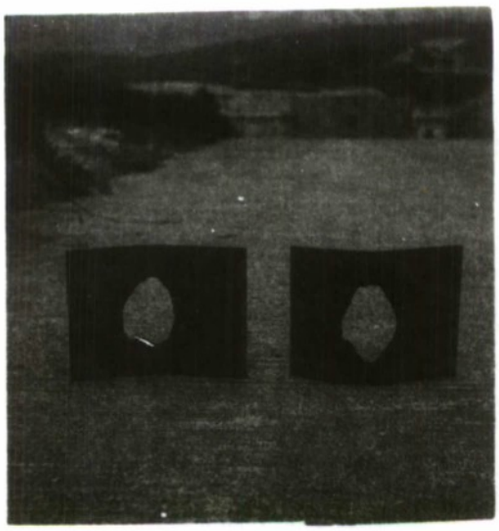


Photo No. 6. The 5/16" plate holed by a clean cut

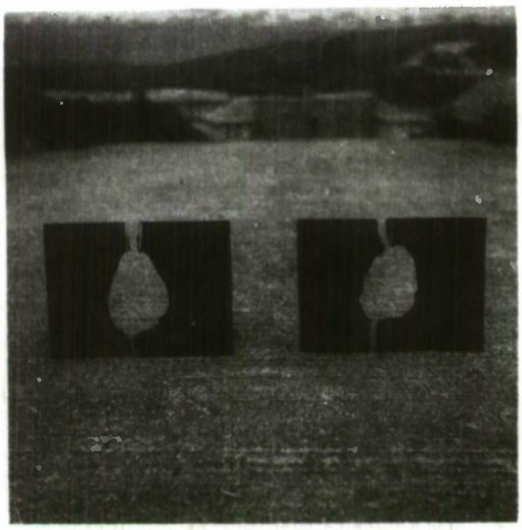


Photo No. 7. The 5/16" plate holed and broken

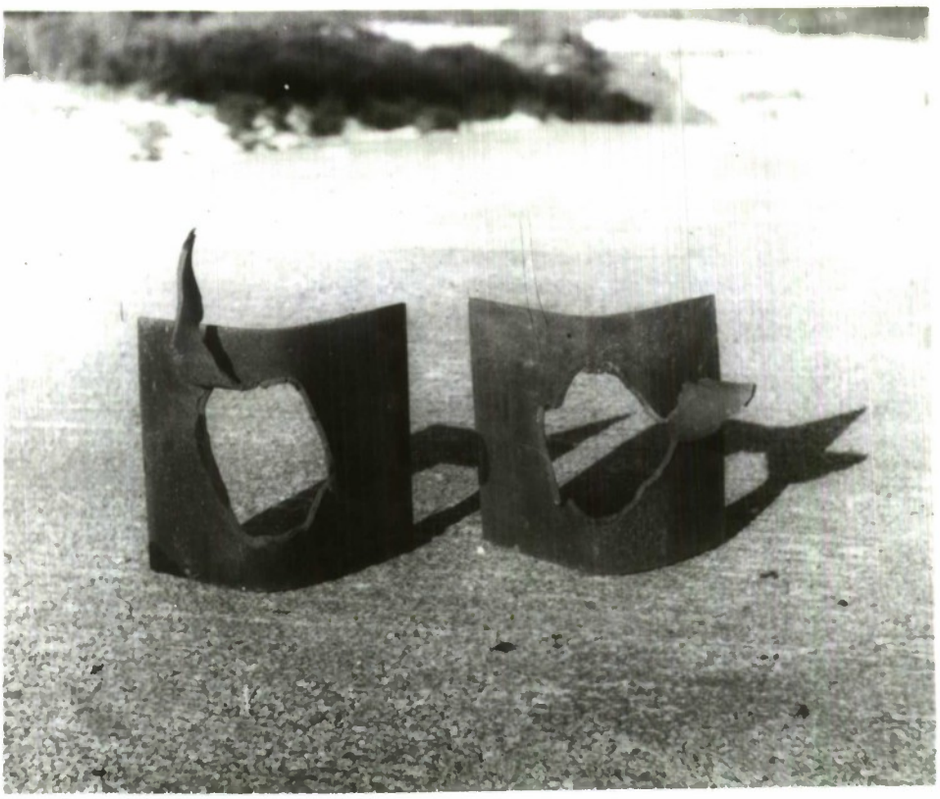


Photo No. 8. The 5/16" plate holed and torn

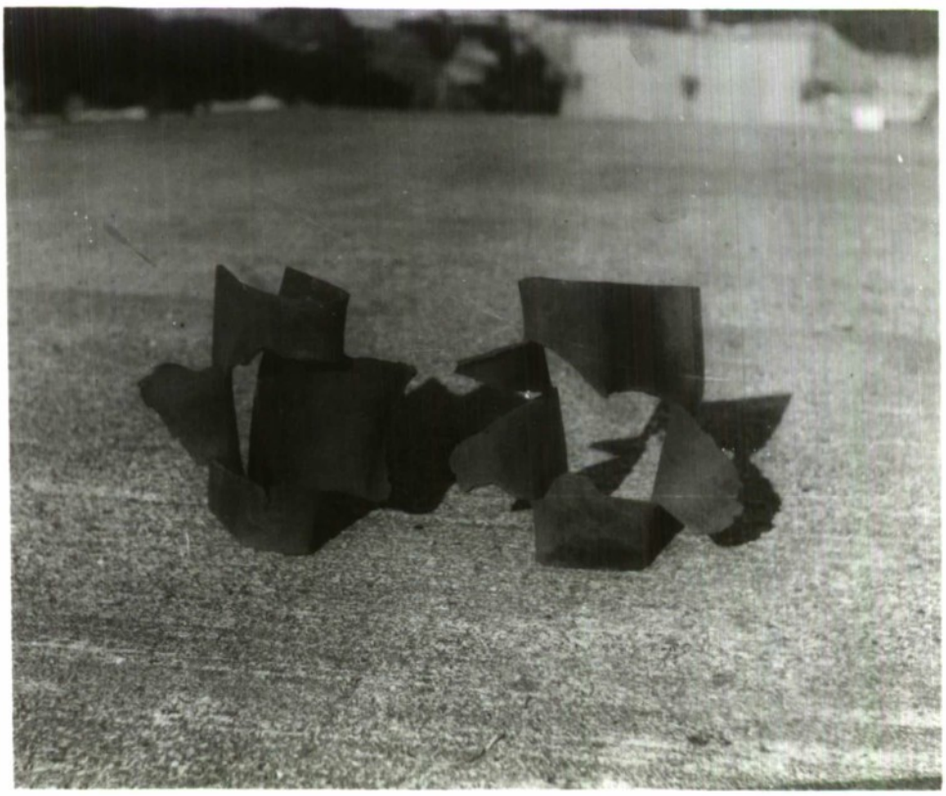


Photo No. 9. The 5/16" plate torn and bent

Photo No. 10. Initiation by detonating cord of cartridge on 1½" witness plate

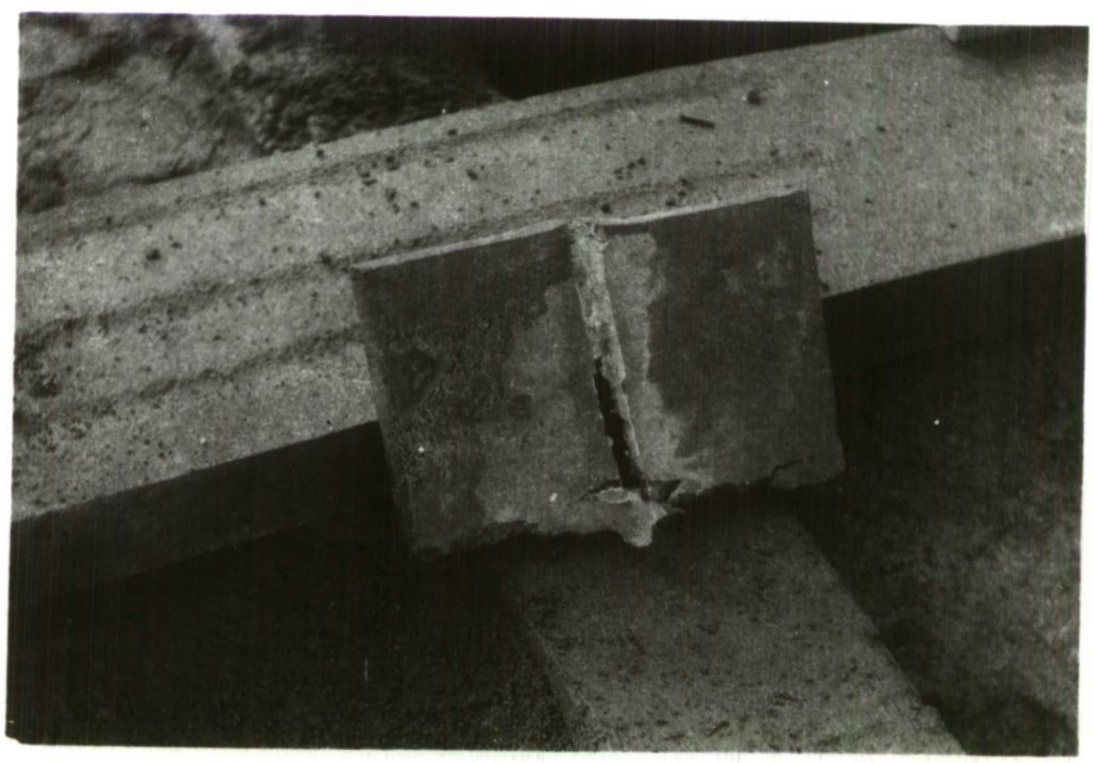


Photo No. 11. The 1½" plate after being cut by 8-oz. cartridge of P.E.

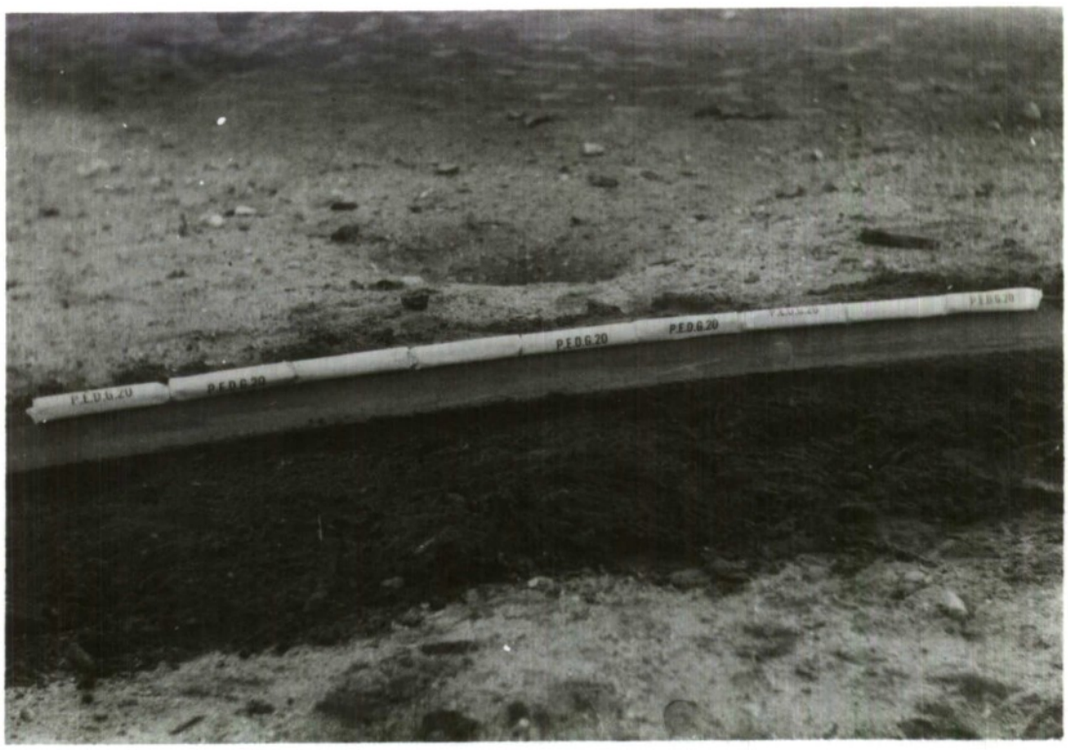
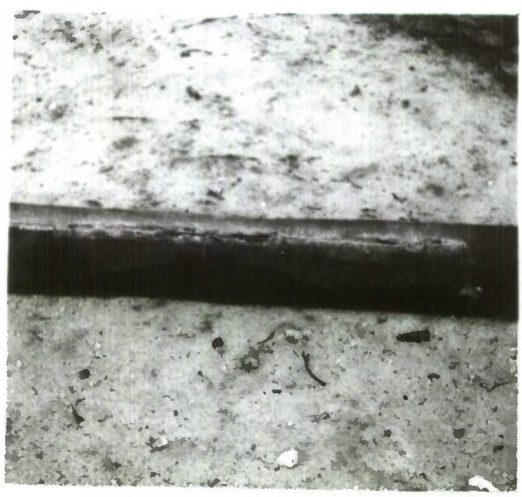
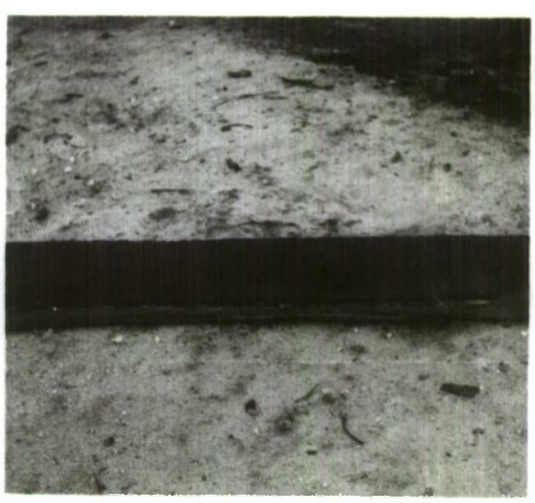


Photo No. 12. Propagation of 9 cartridges in line on a $\frac{1}{2}$" witness plate





Photos 13 & 14. Back and front views of the $\frac{1}{2}$" plate after propagation test

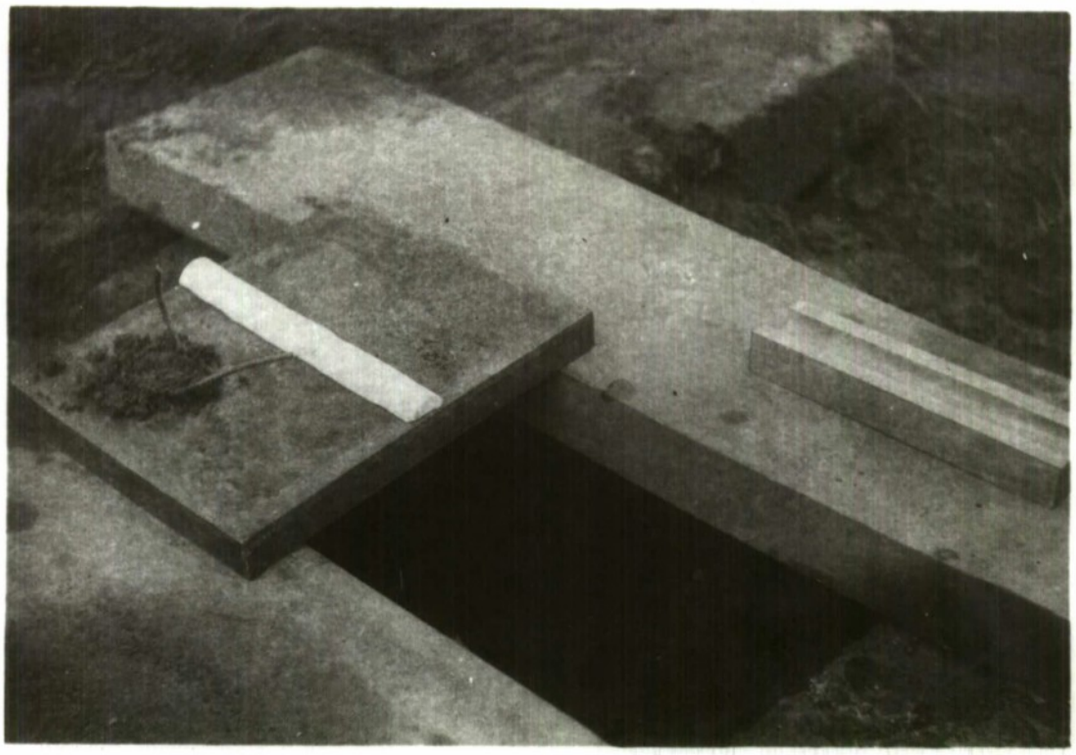


Photo No. 15. Semi-circular charge on 1½" witness plate, also wood mould

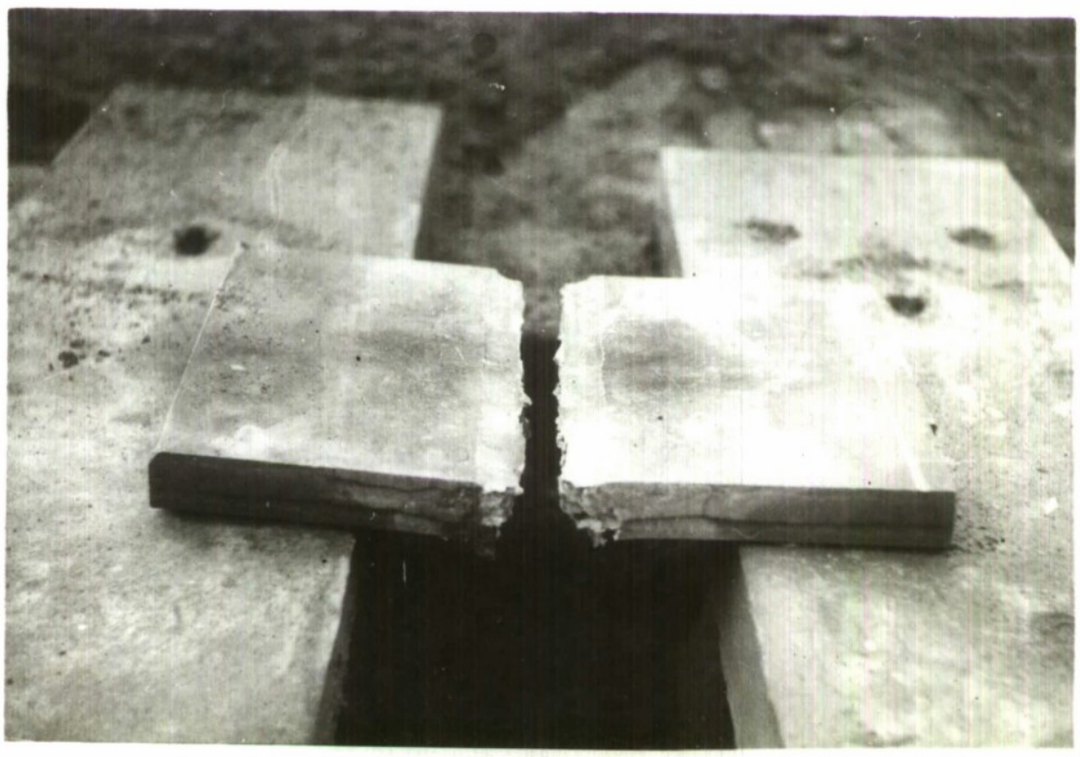


Photo No. 16. The 1½" plate after being cut by 10 oz. of D.G.29.

[dstl]

Information Centre
Knowledge Services
[dstl] *Porton Down,*
Salisbury
Wilts
SP4 0JQ
Tel: 01980-613753
Fax 01980-613970

Defense Technical Information Center (DTIC)
8725 John J. Kingman Road, Suit 0944
Fort Belvoir, VA 22060-6218
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Note With photographs
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